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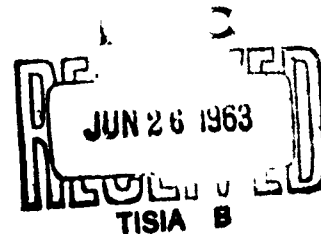
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LABORATORIES DIVISION
INFORMAL REPORT



MATERIALS LABORATORY

PROJECT TITLE: METALLURGICAL EVALUATION OF EXPERIMENTAL PINION, FINAL
DRIVE GEAR

Report No. 3423 (Final)

Date: 24 January 1956

Laboratory Work Order No. 1579

DETROIT ARSENAL
CENTER LINE, MICHIGAN

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Center Line, Michigan

LABORATORIES DIVISION
Materials Laboratory

PROJECT TITLE: METALLURGICAL EVALUATION OF EXPERIMENTAL PINION, FINAL
DRIVE GEAR

Report No. 3423 (Final)

Date: 24 January 1956

Prepared by: John Vettraino

Initiation Date of Project: 11 March 1955

Laboratory Work Order No. 1579

DETROIT ARSENAL
Laboratories Division

Report No. 3423 (Final)

24 January 1956

PROJECT TITLE: METALLURGICAL EVALUATION OF EXPERIMENTAL PINION, FINAL
DRIVE GEAR

OBJECT:

To evaluate the metallurgical characteristics of an experimental
pinion gear.

REMARKS:

The microstructure, case depth, and hardness of this pinion were com-
parable with production fabricated gears and pinions.

MATERIAL SUBMITTED:

Experimental pinion, Ordnance No. 7385298, fabricated from 94B17
Boron steel, designated as 4B.

RESULTS AND DISCUSSION:

Hardness tests were conducted on representative areas of the pinion.
The results are:

<u>Location</u>	<u>Rockwell "C" Scale</u>
Surface, crown of tooth	58-59
Case, pitch line	37-38
Core, root area	31-32

A microhardness traverse was run through the carburized case at the
pitch line and at the root. The results are:

PITCH LINE - 500 GM LOAD - KNOOP INDENTER

<u>Depth, Inches</u>	<u>Knoop No.</u>	<u>Equivalent Rc</u>
0.001	810	63.5
.002	786	62
.003	786	62
.004	765	61
.010	760	61
.020	745	60.5
.030	732	60
.040	732	60
.050	650	56
.060	603	53.5
.070	603	53.5
.080	575	52
.085	568	51.5
.090	517	48.5

Effective case depth - 0.080 inches

Total case depth - 0.105 inches

ROOT LINE TRAVERSE - 500 GM LOAD - KNOOP INDENTER

<u>Depth, Inches</u>	<u>Knoop No.</u>	<u>Equivalent Rc</u>
0.001	786	63
.002	760	61
.003	760	61
.004	760	61
.010	745	60.5
.020	745	60.5
.030	724	59.5
.040	724	59.5
.050	691	58
.060	650	56
.070	593	53
.079	575	52
.084	517	48.5
.089	517	48.5

Effective case depth - 0.081 inches

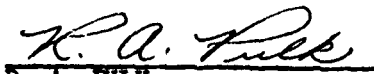
Total case depth (estimated) - .100 inches

Microscopic examination of specimens taken from the carburized case of the pinion revealed a microstructure consisting of tempered martensite with finely dispersed, small spheroidal carbides (Figure 1) The core microstructure consists of coarse grained, tempered martensite and small areas of finely dispersed ferrite (Figure 2).

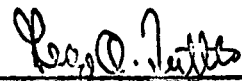
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Report No. 3423 (Final)

DETROIT ARSENAL
Laboratories Division

TECHNICAL REPORT DISTRIBUTION

Report No. 3423 (Final)

PROJECT TITLE: METALLURGICAL EVALUATION OF EXPERIMENTAL PINION, FINAL
DRIVE GEAR

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Chief, Materials Laboratory, Laboratories Division	(1)
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INCLOSURE SHEET

Report No. 3423 (Final)

Project Directive, dated 11 March 1955

Inclosure 1

Figure 1, Neg. No. A1372, Gear, Final Drive Pinion,
7385298. Representative Case Microstructure Inclosure 2

Figure 2, Neg. No. A1373, Gear, Final Drive Pinion, 7
7385298. Representative Core Microstructure Inclosure 2

IBinder/dp/23-240

11 March 1955

Project Directive

OBJECTIVE: To evaluate the metallurgical properties of an experimental final drive pinion.

MATERIAL SUBMITTED: One (1) final drive pinion (stamped #2B) representative of a lot of ten (10) pinions manufactured in accordance with Ordnance Drawing 7385298 with the exception that 94B17 boron steel was employed in place of the specified alloy steel.

PROCEDURE:

1. Physical test:

Hardness: Conduct complete hardness survey as follows:

- a. Rockwell "C" survey on surface of teeth.
- b. Microhardness of carburized case.
- c. Rockwell "C" hardness of core section measured at pitch line.

2. Metallographic: A microscopic examination of the carburized case and core including the following:

a. Case depth estimation, both total and effective, taken at pitch and root area; total case being defined as the distance (measured perpendicularly) from the surface of the case down through the carbon enrichment and effective case depth being defined as the distance (measured perpendicularly) from the surface of the hardened case to a point of hardness equivalent to Rockwell C-50.

b. Microstructure evaluation of case and core sections with representative photomicrographs at 500X of case.

c. Microstructure evaluation of any conditions deviating from normal with representative photomicrographs at 500X.

3. It is requested that two (2) memorandum reports be prepared and forwarded to Materials Br, Research & Development Division. For further information, contact Mr. I. Binder, extension 23-240.

INITIATED BY:

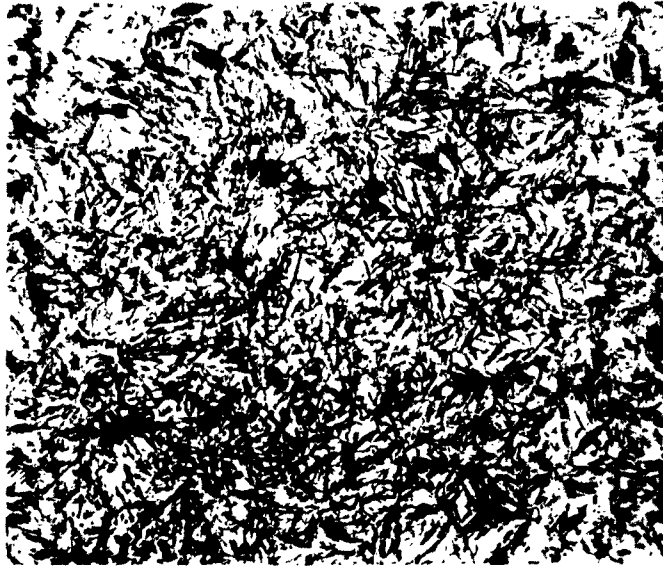
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Metals Section

APPROVED BY:

John P. Jones
John P. Jones, Chief
Materials Br, R&D



A 1372

Figure 1

Gear, Final Drive Pinion, 7385298. Representative Case Microstructure. Etchant: 2% Nital, 500X Magnification.



A 1373

Figure 2

Gear, Final Drive Pinion, 7385298. Representative Core Microstructure. Etchant: 2% Nital, 250X Magnification